Fisheries and Oceans Canada | Pêches et Océans Canada
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Quebec Region
Canadian Science Advisory Secretariat
Science Advisory Report 2012/079

THE SAGUENAY FJORD WINTER RECREATIONAL GROUNDFISH FISHERY, 2011-2012

Figure 1. Main fishing sites in the Saguenay Fjord.

Context

The winter recreational fishery carried out in the Saguenay Fjord has taken off in the early eighties. It is unique in Quebec by its magnitude and the variety of species that are caught in that area. Enthusiasts of this sport generally come from cities and towns near the fishing sites. However, this activity has sparked interest among North American and even European tourists, who use the services of outfitters. With sizeable socio-economic impacts, the winter sport fishery is a driving force for the region's tourism industry.

As a result of the growing interest in this recreational/tourism activity, various stakeholders are now concerned about resource conservation and the sustainable development of the fishery. In this context, a monitoring program was launched in 1995 under a research agreement involving Saguenay Fjord fishermen associations and committees; Promotion Saguenay; the Musée du Fjord; Rio Tinto Alcan; the Ministère des Ressources naturelles du Québec; the Société des établissements de plein air du Québec and the Parks Canada, which co-manage the Saguenay-St. Lawrence Marine Park; and the Department of Fisheries and Oceans (DFO), which is responsible for scientific monitoring and assessment of groundfish stocks as well as resource protection.

Assessment of groundfish populations is performed every second year and the main indicators are data from the winter recreational fishery and abundance indices derived from a DFO research survey.

SUMMARY

- The 2011 and 2012 fishing seasons were shortened following the recommendation from Science to reduce fishing effort. They opened on the third week of January and ended the first week of March. These fishing seasons were the shortest since the launching of the monitoring program in 1995.

- The reduction of the fishing season resulted in a decrease of the total groundfish fishing effort in the Saguenay as a whole. Values for 2011 and 2012 are below the series average.

Canada

- Redfish represented 92% of groundfish catches in the 2011 and 2012 recreational fishery. The number of catches per unit of effort (NUE) from the fishery and from the scientific survey shows a continuous downward trend from 1996 to 2010, followed by a slight increase since. Size structures suggest that the 1980 *Sebastes mentella* redfish cohort has mainly been exploited.

- Atlantic and Greenland cod represented 7% of groundfish catches in the 2011 and 2012 recreational fishery. Atlantic cod NUE in the fishery and scientific survey increased between 2005 and 2010 and have stabilized since. Greenland cod NUE remains at a very low level.

- Greenland halibut (turbot) represented 1% of groundfish catches in the 2011 and 2012 recreational fishery. The NUE of the fishery shows no trend and the science mission shows a stepwise increase between 2000-2004 and 2005-2012.

- Saguenay redfish remain at a very low level. Groundfish recruitment to the Saguenay relies on the arrival of juveniles from the Estuary. Therefore, exploitation does not affect the recruitment of redfish or of other groundfish to the Saguenay, but determines the speed at which these stocks decline and can impact the integrity of the ecosystem. Consequently, it is recommended to maintain the current management measures.

INTRODUCTION

Background

During the Saguenay winter recreational fishery, the main groundfish species sought are redfish (*Sebastes* spp.), Atlantic cod (*Gadus morhua*), Greenland cod (*Gadus ogac*) and Greenland halibut, also called turbot (*Reinhardtius hippoglossoides*). There is also rainbow smelt (*Osmerus mordax*), a pelagic species, which is also of considerable interest to fishermen, but it is not considered in this report. Those interested in obtaining information on the Saguenay Fjord rainbow smelt can contact the Ministère des Ressources naturelles du Québec in Jonquière (Saguenay-Lac-Saint-Jean@mrn.gouv.qc.ca)

Based on different methods (genetic, morphometric, parasite assemblage, chemical composition of otoliths), Sévigny et al. (2009) concluded that Saguenay groundfish populations are sink populations whose recruitment depends on populations from the St. Lawrence. Sirois et al. (2009) found that groundfish larvae do not survive in the Saguenay waters. The phenotypic differences observed between Gulf of St. Lawrence and Saguenay populations support the hypothesis of a migration at the juvenile development stage (Sévigny et al., 2009). The recruitment of Saguenay populations is linked to the status of Estuary and Gulf of St. Lawrence populations.

The latest scientific advice on these Gulf of St. Lawrence species indicates that:

- Redfish has a "relatively low level of biomass observed and the prospect of only typical low recruitment ..." (DFO, 2010),

- "The spawning stock abundance [for the northern Gulf of St. Lawrence cod] for 2012 and projected to 2014 is well below the limit reference point. The stock has remained in the critical zone for the last 23 years." (DFO, 2012),

- "The southern Gulf [cod] population is at the lowest level observed in the 61-year record and is declining." (DFO, 2011a),

- "The significant decline observed in the biomass indices (kg/tow) [for Greenland halibut] from the two surveys from 2007 to 2009 has stopped in 2010, but the indices are still below the average of the last ten years. The 2005, 2008 and 2009 cohorts were weak according to the two surveys and are likely to reduce the exploitable portion over the next few years." (DFO, 2011b).

Fishery Description and Conservation Measures

The winter recreational fishery is practiced over the entire upper basin of the Saguenay Fjord, between Saint-Fulgence and Petit-Saguenay. The main fishing villages are associated with the municipalities of Anse-Saint-Jean, Rivière-Éternité, Saint-Félix-d'Otis, Sainte-Rose-du-Nord, Saint-Fulgence and the La Baie area, the latter encompassing Anse-à-Benjamin, Grande-Baie and Les Battures (Figure 1). More than 80% of the fishing effort is deployed in the latter three sites. In 2012, 1,380 fishing huts were deployed in La Baie area for a total of 1,702 (Guy Girard, Promotion Saguenay, pers. comm.). Generally, fishing sites include two areas: a "pelagic fish" area, where mainly smelt is caught, and a "groundfish" area where are located fishing huts from where fishermen target the species discussed in this report. The second area is located in deeper waters.

Fishermen use two main types of fishing gear: rods for light-line fishing and the tip-up, described as a fishing line mounted on a signalling device that alerts them when a fish takes the bait. There are three main approaches to ice fishing. The first consists in being on site continuously, paying close attention to the gear. When a fish takes the bait, the fisherman pulls up the line, removes the fish, baits the hook and lowers it back into the water. The second approach is of a social nature. Gears are baited and lowered into the water, but fishermen are less attentive. Therefore, a fish that takes the bait could be on the line for a number of hours before being pulled up, making it impossible to catch other fish during that time with this gear. The third approach consists in baiting and lowering gears in the evening and checking the lines only the next day, at the beginning or at the end of the day. The prevalence of these three approaches varies from one site to another.

Conservation measures were introduced at the beginning of the 2004 winter fishery, reducing the daily catch limit to 5 individuals of any groundfish species and by delaying the opening of the fishery to mid-January. The frequentation average (Figure 2) over the 1996-2010 period was around 40,000 fishermen-days. In 2008 and 2009 favourable ice conditions allowed for an increase above average of the frequentation. In 2010, sites were installed 1-2 weeks after the fishing season was opened and ended 3-4 weeks earlier than scheduled, due to the thinning ice. As a result, there was a drop in frequentation at around 22,000 fishermen-days. In 2011 and 2012, new management measures were put in place to further reduce the fishing season to 44 days. This reduction in fishing effort translated in a decrease in frequentation with values below the series average. In 2012, the low fishermen-day value would also be due to poor ice condition, more specifically at the Anse-à-Benjamin site.

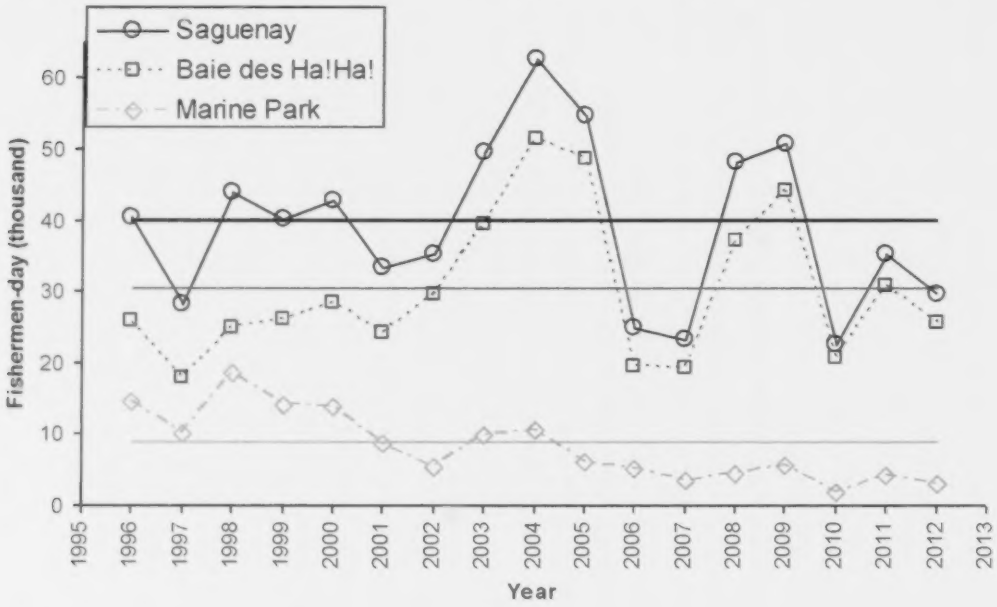


Figure 2. Annual fishermen-day index. Horizontal lines represent respective series average for the period 1996-2010.

ASSESSMENT

Data Source

Since 1995, DFO has been monitoring the winter recreational fishery in the Saguenay, focusing on the main marine species harvested: redfish, Atlantic cod, Greenland cod, and Greenland halibut. The program is two-fold and requires the participation of volunteer fishermen from the eight main fishing sites. In addition, Promotion Saguenay de ville Saguenay, the Musée du Fjord Saguenay, Ressources naturelles et faune Québec, the Saguenay-St. Lawrence Marine Park (Quebec) and the Saguenay-St. Lawrence Marine Park (Canada) have significantly contributed to the assessment of the exploited fish populations in the Saguenay Fjord.

The first part of this program involves sampling fishermen. Around 20 interviews with 15 fishermen are conducted every year at each site. These interviews occur both on week days and weekends throughout the season. Data on catches (numbers, species) and fishing effort (number of hooks, number of fishing hours) are collected. Since 2010, the use of depth sounders has also been noted. The second part of this program focuses on the collection of biological data. For each observation, the species, size and weight are recorded.

Since 2000, a scientific research survey has been conducted by boat in the Saguenay Fjord. This survey was performed annually from 2000 to 2010 and every two years since 2012. This gillnet survey is conducted as soon as possible following winter recreational fishery closure, in April. Sampling stations are grouped in Saint-Fulgence and La Baie area, upstream from the marine park limits. The fishing effort has increased from about 30 anchoring sites in the first few years to 80 in 2012.

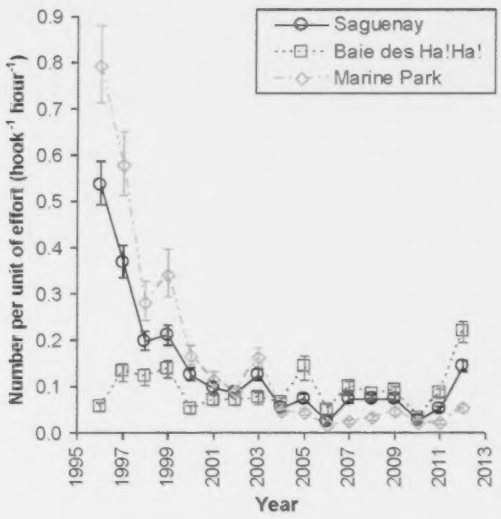
Status of the Resource

Redfish

Redfish catches are the highest in the winter groundfish fishery in the Saguenay Fjord, representing about 92% of landings in 2011-2012.

For the Saguenay as a whole, the recreational fishery abundance index has declined steadily from 1996 to 2010, followed by a slight increase since (Figure 3A). This general downward trend is also evident in the research survey from 2000 to 2010 (Figure 3B). The 2012 value shows a slight increase.

A) Recreational fishery



B)Research survey

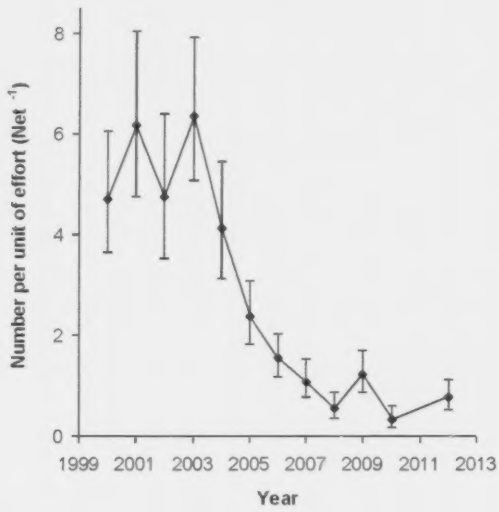


Figure 3. Redfish catch rates from the recreational fishery (A) and the research survey (B). The vertical lines represent 95% confidence interval. Saguenay includes all 8 recreational fishing sites. Baie des Ha! Ha! includes data from Anse-à-Benjamin, Les Battures, and Grande-Baie. Marine Park includes data from Ste-Rose-du-Nord, L'Anse-St-Jean, Rivière-Éternité, and St-Félix-d'Otis.

The same analysis conducted at sites located within the marine park limits showed similar results. The downward trend is even more obvious however values for 2011 and 2012 remain low. The situation is different if the analysis is done only with the three Baie des Ha! Ha! sites. The index of abundance which had stayed quite stable from 1996 to 2010 increased in 2011 and 2012. This rise in NUE in Baie des Ha!Ha! is responsible for the increase seen in the Saguenay. This could be due to the increasing use of echosounders in this recreational fishery.

The total estimated catch of redfish (Figure 4) shows a decreasing trend until 2010. The total catch is increasing in 2011 2012 and shows value similar to those of 2006-2008. Annual variations are sometimes very large, and are explained by the variability of fishing effort and annual catch rate differences specific to each site. The total catch obtained within the marine park limits has declined between 1996 and 2006 and has remained low and stable since, representing less than 5% of redfish landed in the Saguenay for this period.

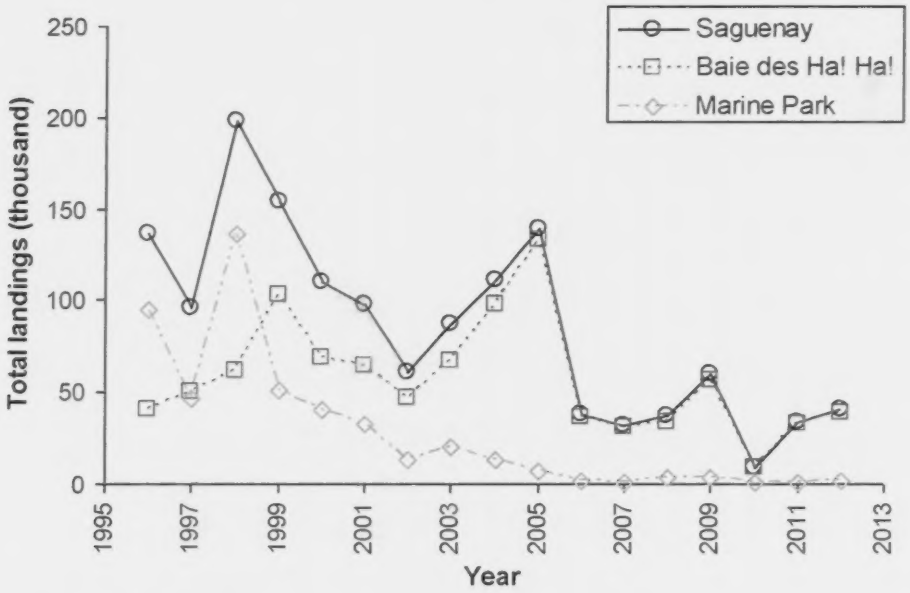


Figure 4. Total redfish landings.

Gears used to catch redfish in the Saguenay, handline in the recreational fishery and gillnet in the research survey, have different selectivity. Hence handline is less selective and allows the catch of a wider range of fish sizes than gillnet (Figure 5). In the recreational fishery, redfish less than 20 cm are occasionally seen, indicating the sporadic presence of young individuals. However, the slow but constant augmentation in redfish mean size since 1996 suggests that there has not been an important arrival of recruits and that the recreational fishery is supported by one or a few redfish cohorts. In the DFO research survey, the narrow selectivity of gillnet for redfish does not allow to evaluate the recruitment and, as in the winter fishery, the growth from 30.4 to 32 cm of redfish between 2000 and 2012 suggest that there has not been an important arrival of small redfish.

Atlantic cod

For the Saguenay as a whole, the recreational fishery abundance index (Figure 6A) decreased between 2000 and 2007. In 2008, the index surged and has remained high since. Even though a slight decrease is seen in 2011 and 2012, the current abundance index level is comparable to the first years of the series. The situation is similar when considering only sites within the marine park. In the latter case however, the increase observed since 2008 did not match the level from the early part of the series and the decrease in 2011 and 2012 is more pronounced. The catch rate for the Baie des Ha! Ha! sites shows significant annual fluctuations. Data for 2011 and 2012 are above the series average and are at level comparable to those of the marine park.

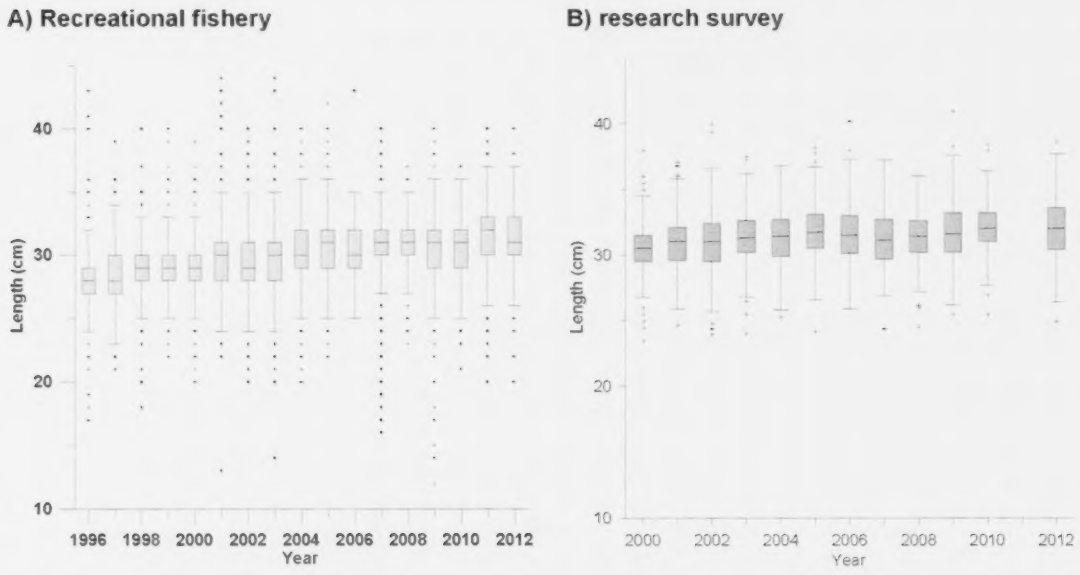


Figure 5. Redfish size frequency distribution from the recreational fishery (A) and the research survey (B). Box-and-whisker plot: median is shown by the line in the middle of the box, the box spread from percentile 25 to 75 and whiskers (vertical line on each side of the box) represent 1,5 times the interquartile (distance between Q1 and Q3) and crosses represent extreme value.

The research survey seems ineffective at catching Atlantic cod. Between 2 and 66 Atlantic cod were caught annually in the survey. Catch rates have fluctuated without clear trend from 2000 to 2005 (Figure 6B). The results of recent years suggest the possibility of an increase.

The total estimated catch (Figure 7) of Atlantic cod in the recreational fishery appears to be greatly influenced by the fishing effort in the Baie des Ha! Ha! (Figure 2). Even though catches show important fluctuations, a decrease is seen with a minimum in 2007 and stabilisation at a low level since.

The small sample size of Atlantic cod measured both in the winter fishery and in the research survey (Figures 8A and 8B) does not allow to clearly distinguish cohorts. The selectivity of hand line used in the recreational fishery allows to catch of a wider size range of Atlantic cod than the gillnet used in the research survey, (Figure 8A and B). Atlantic cod from 20 to 100 cm in length are present in the fishery indicating a regular arrival of new individuals in the population which contribute to the renewal of the stock.

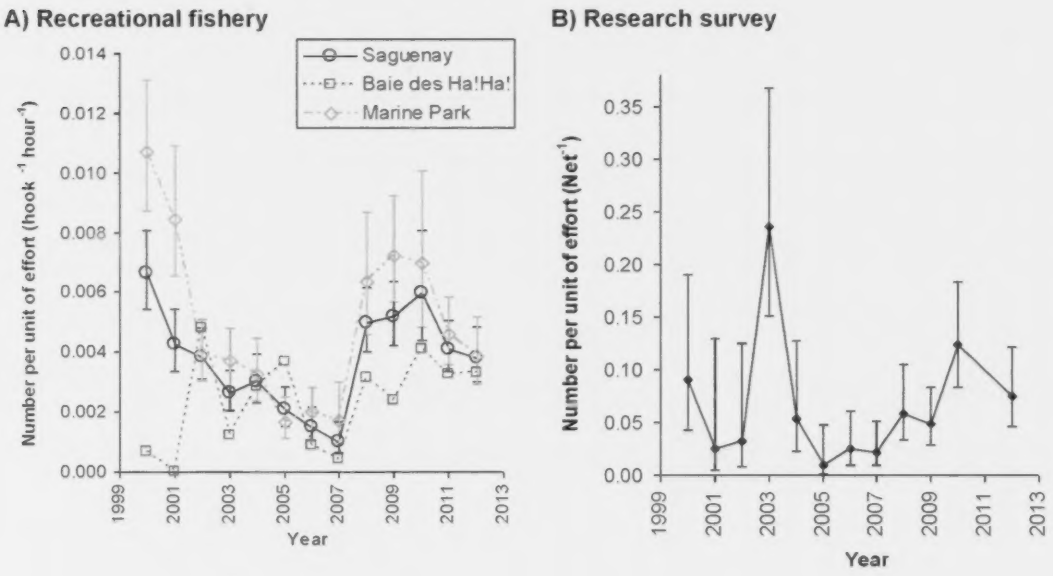


Figure 6. Atlantic cod catch rates from the recreational fishery (A) and the research survey (B). The vertical lines represent 95% confidence interval.

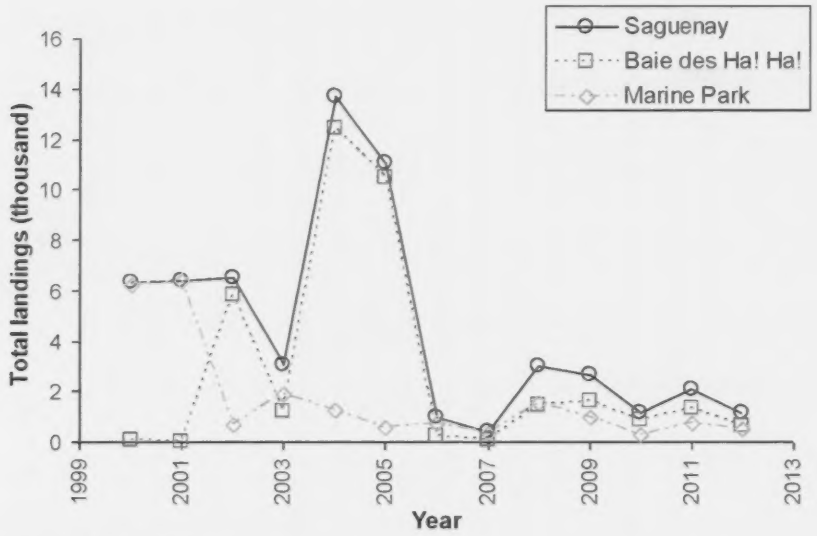


Figure 7. Total Atlantic cod landings.

Greenland cod

For the Saguenay as a whole, the recreational fishery abundance index (Figure 9A) shows a downward trend between 2000 and 2007. Since 2008 the index is at low level. This decrease is more evident when considering only sites within the marine park limits, and even though at the

beginning of the time series, the index was higher in the marine park compared to Baie des Ha!Ha!, values are similar since 2007 in those two areas.

Greenland cod, as Atlantic cod, is an occasional catch in the research survey (Figure 9B) which makes data interpretation hazardous. Greenland cod catches varied from 1 to 23 fish annually. There seems to be a reduction in this index between 2000 and 2008 witch stabilised at a low level since.
The total estimated catch of Greenland cod in the recreational fishery decreased between 2000 and 2007 going from 27,101 to 563 fish (Figure 10). The total estimated catch stabilised thereafter with an annual mean value of 1,300 individuals since 2008.

Tracking of cohort is not possible du to the low catch both in the recreational fishery and in the research survey. However there is a regular presence of individuals of 30 cm and less in the recreational fishery indicating a steady arrival of young fish (Figure 11). We do not currently have the tools to measure their abundance.

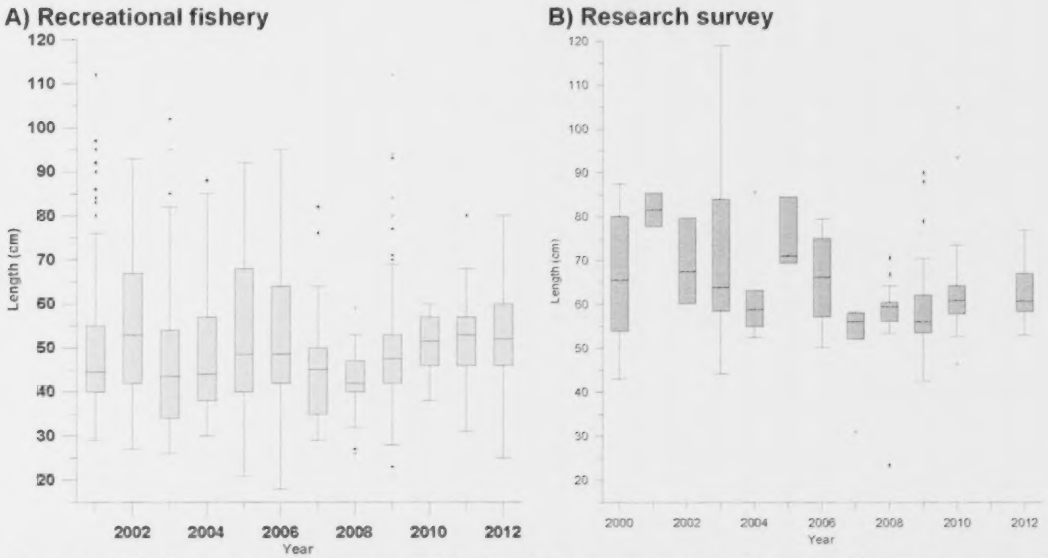


Figure 8. Atlantic cod size frequency distribution from the recreational fishery (A) and the research survey (B).

Greenland halibut

Greenland halibut is a rare catch in the recreational fishery hence the interpretation of catch rate as an index of abundance is very speculative (Figure 12A). Catches in the research survey are however important and this abundance index suggest a stepwise increase of Greenland halibut in the Saguenay from 2000-2004 to 2005-2012 (Figure 12B).

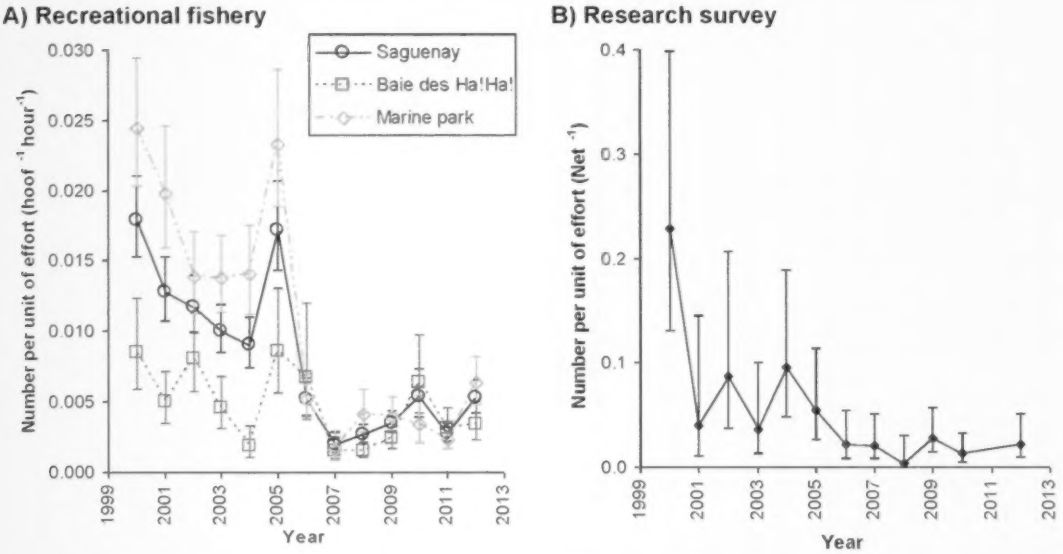


Figure 9. Greenland cod catch rates from the recreational fishery (A) and from the research survey (B). The vertical lines represent a 95% confidence interval.

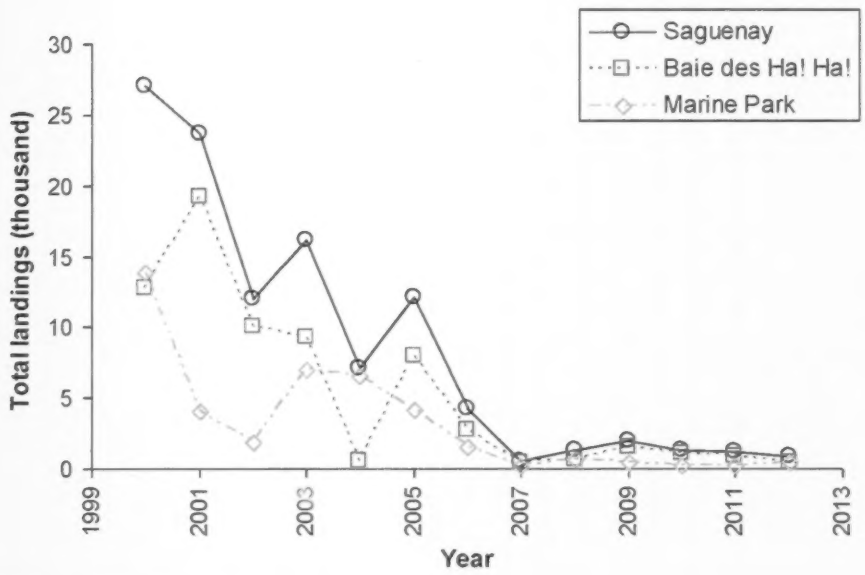


Figure 10. Total Greenland cod landings.

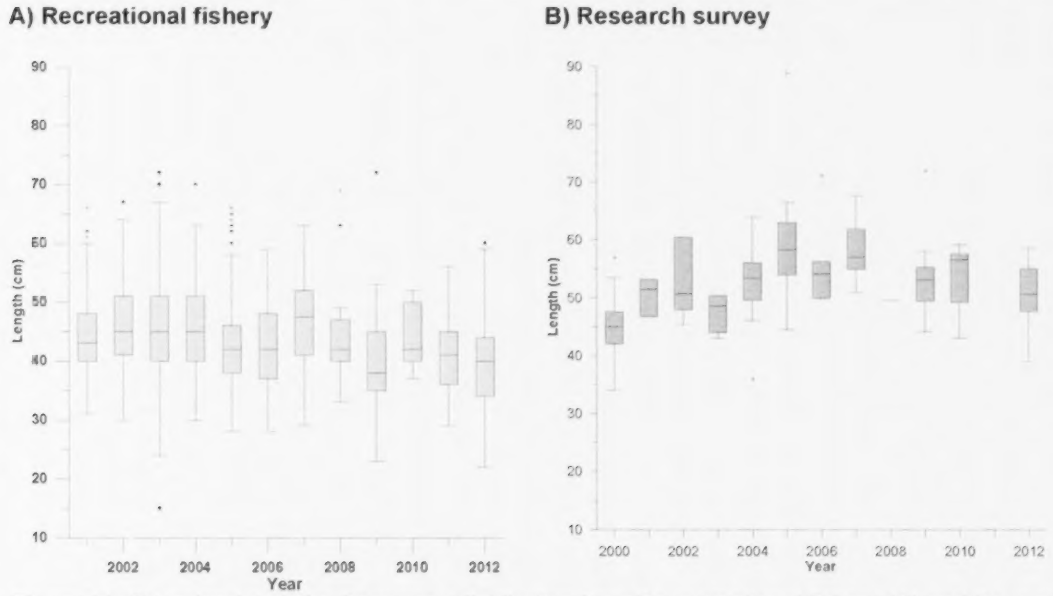


Figure 11. Greenland cod size frequency distribution from the recreational fishery (A) and the research survey (B).

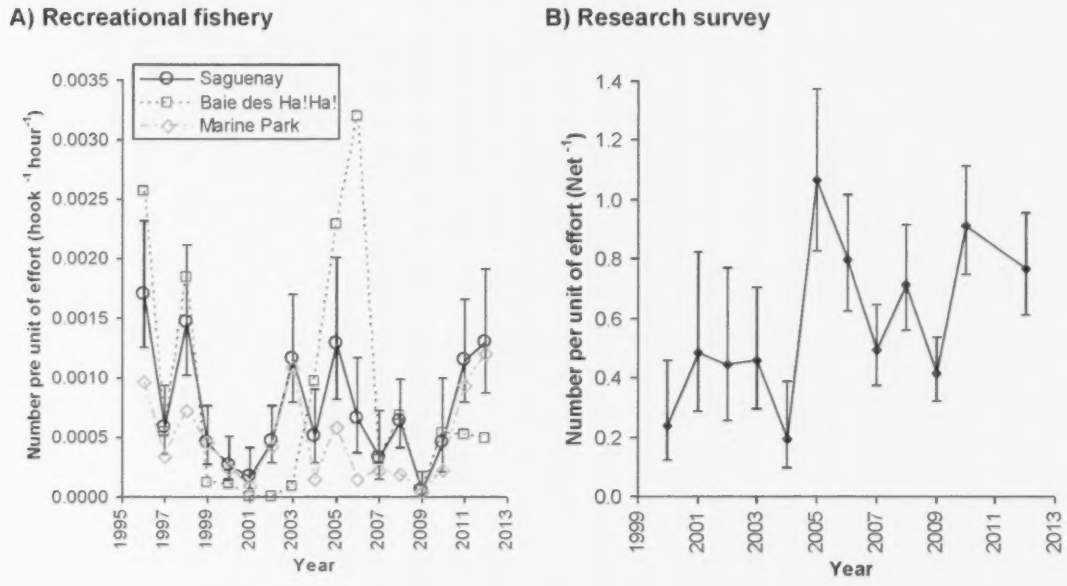


Figure 12. Greenland halibut catch rates from the recreational fishery (A) and the research survey (B). The vertical lines represent a 95% confidence interval.

The estimated total landings (Figure 13) in the recreational fishery are generally weak and heavily influenced by sampling. Catches at one site are multiplied by the effort at this site. A few extra fish at a very busy site will induce a large variation. The average annual landing estimated for the last five years is 295 individuals.

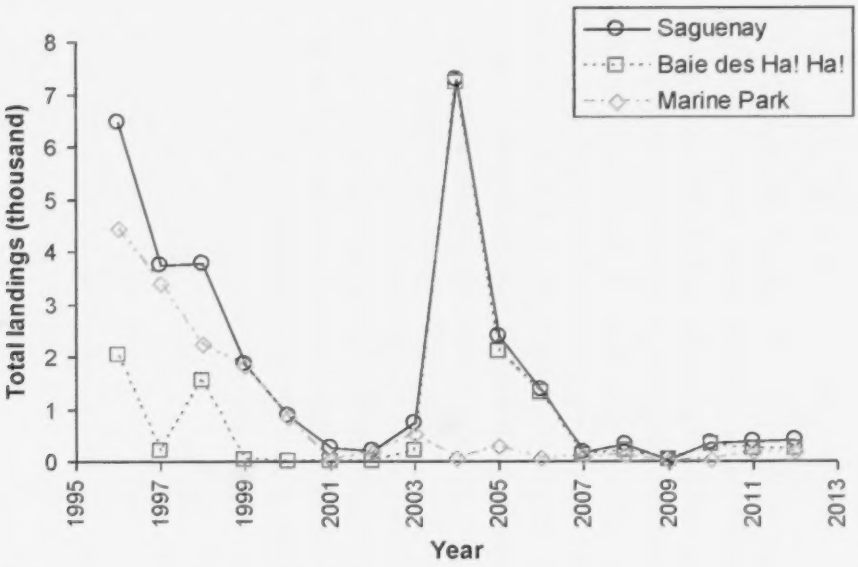


Figure 13. Total Greenland halibut landings.

The small sample size in the recreational fishery (annual mean of 7 fish since 2008) does not permit to monitor cohorts (Figures 14A and 14B). However a wide range of fish size caught in the Saguenay indicate the presence of many cohorts. The selectivity of gillnet used in the research survey does not help in tracking cohorts. The presence of individuals between 35 and 65 cm however indicates a renewal of this species.

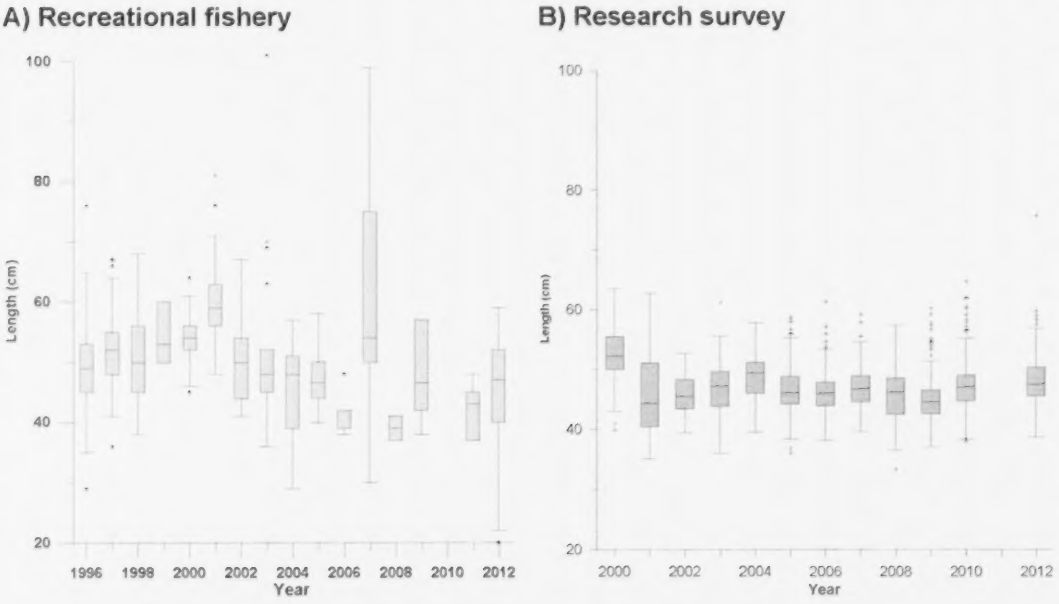


Figure 14. Greenland halibut size frequency distribution from the recreational fishery (A) and the research survey (B).

Sources of Uncertainty

The calculation of the annual effort (Figure 2) and, consequently, the total catch (Figures 4, 7, 10 and 13) requires knowing the duration of the fishing season, the average number of fishermen per day and, for the total catch, the average daily effort. The approximation methods used to determine these three variables are slightly biased, and current information is insufficient to quantify their uncertainty and the seasonal evolution of this bias.

The use of a depth sounder has become widespread in recent years in the Saguenay recreational fishery. This technological development results in an increase in fishing efficiency and thus represents a challenge in comparing indicator levels at the beginning and at the end of the time series. No correction was applied to the data to compensate for this new technology. A comparison of annual catch rate with and without the use of the depth sounder will be presented at the next assessment.

Theoretically, the best abundance indices are those that cover adequately the geographical distribution of a stock as well as its age classes (area sampled and selectivity of the gear). It is also preferable that the sampling be done when fish are well dispersed and catchable. For the Saguenay, such ideal indicator does not exist; we only have partial abundance indices. The recreational fishery is performed in winter at restricted sites located in bays of shallow to medium depth; hence the spatial coverage is weak in comparison to the expected distribution of the targeted species. The selectivity of gear used, handline, allows to catch a good range of fish sizes but does not seem adequate to capture juvenile fish. The DFO research survey is not optimal either. The spatial and temporal coverage is restricted and the gear used (gillnet) has a narrow selectivity that targets specific fish sizes. This survey is not a good indicator of the presence of recruitment of fish population in the Saguenay. It would be useful to develop recruitment indices for groundfish populations of the Saguenay.

CONCLUSIONS AND ADVICE

The interest in the winter recreational fishery in the Saguenay Fjord keeps growing since the beginning of the 1990s. Information from Promotion Saguenay indicates that the number of huts went from 1,000 to more than 1,700 between 1998 and 2012. The number of fish caught in this recreational fishery is considerable. The data available suggest that the status of marine resources harvested in the Saguenay River is of concern. Redfish, Atlantic and Greenland cod and Greenland halibut landings have dropped considerably compared to the mid 1990s and have stabilised at a low level for a number of years now. Abundance index derived from the fishery and the survey show an important decline of redfish that constitute the main catch for this fishery. Moreover, studies have shown that recruitment of groundfish in the Saguenay depends on the arrival of juvenile from the Estuary. Knowing that there has not been a major entry of redfish in the Saguenay within the past 30 years and that redfish population in the Gulf of St. Lawrence have collapsed, sustainability of redfish in the Saguenay is uncertain. However, the daily catch limit of 5 groundfish introduced in 2004 as well as the reduction of the fishing season in 2004 and again in 2011 seem to have contributed to stabilised catch levels and reduce fishing effort in 2011 and 2012. It is thus imperative for the upcoming 2013 and 2014 winter fishing season to maintain these management measures that are the daily catch limit of five groundfish and the duration of the fishing season to 44 days as in 2011.

SOURCES OF INFORMATION

This Science Advisory Report is from the Fisheries and Oceans Canada Canadian Science Advisory Secretariat regional advisory meeting of November 22, 2012 on assessment of the Saguenay Fjord Winter Sport Fishery held at the Maurice Lamontagne Institute in Mont-Joli, QC. Additional publications from this process will be posted as they become available on the Fisheries and Oceans Canada Science Advisory Schedule at www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

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